

Weekend Ozone Effect During Ozone-Conducive Days in the South Coast Air Basin

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I. Goals

- To describe the weekend effect of ozone in the South Coast Air Basin during ozone-conducive days; and
- To evaluate whether ozone behaves differently than it does when analyzed across all days, as was done in “A characterization of weekday-weekend ambient ozone concentrations in California” (Austin and Tran, 1999).

II. Data & Methods

- use basinwide daily 1-hour maximum ozone concentration
- evaluate two periods: 1992-1994 (pre-CBG) and 1996-1998 (post-CBG).
- fit smoothed (base) line to basinwide ozone max conc from all days (365 days in each year).
- get adjusted (residual) concentrations by subtracting smoothed values from observed concentrations → removed other sources of variation.
- isolate only ozone season: May 17 – October 15.
- summarize mean adjusted (residual) concentrations by day of week (DOW) for all days → All Days.
- use Larry Larsen’s equations – “Cleaner-Burning Gasoline: An Assessment of Its Impact on Ozone Air Quality in California”, January 1998 -- for predicting basinwide daily 1-hr max ozone based on meteorological conditions in the basin (surface and aloft temperatures). Since these equations were developed for basinwide max. conc, our results could not be compared directly with previous work on site-specific DOW patterns (Austin and Tran, 1999).
- stratify days into three groups of ozone-conducive levels based on predicted ozone: Low (≤ 0.12 ppm), Medium (>0.12 ppm but ≤ 0.16 ppm), and High (> 0.16 ppm) → resulted in approximately equal number of data points in each group.
- summarize mean adjusted concentrations by DOW for each group (rather than percent changes in concentration from day to day).
- plot means and compare patterns between groups, across All Days, and between pre-CBG vs post-CBG periods.
- with the WE effect already known to exist in the SoCAB, this study focuses on comparing (that is, estimating) patterns of ozone behavior rather than testing for statistical significant differences between days. (Hence, there is no need for the logarithmic transformation to the original data.)

III. Results

- typical weekend pattern of ozone -- increasing from Fri to Sat, remaining almost the same on Sun, then decreasing from Sun to Mon – exists in High and Low categories as well as All Days, for both periods.
- pre-CBG: for Low and High groups, ozone decreases from Thursday to Friday and increases similarly on Saturday and Sunday. But for the Medium group, ozone increases from Thursday to Friday, followed by a steep increase on Saturday and a decrease on Sunday.
- post-CBG: for Low group, ozone increases from Thursday to Friday, then increases on Saturday and Sunday – as in the pre-CBG period. For the Medium group, ozone decreases from Thursday to Friday, then followed by a weekend behavior similar to pre-CBG period. For the High group, ozone decreases from Saturday to Sunday in post-CBG period; it increases in the pre-CBG period.
- during High ozone-conducive days in both periods, ozone tends to rise during the week to a peak on Thursday, then decreases on Friday before exhibiting the typical weekend pattern.
- overall, weekend patterns for both High and Low groups are similar to that across All Days, unlike the Medium group.
- whereas in Austin & Tran (1999), Sunday ozone was highest compared to other days after CBG for many sites, the “Sunday effect” does not exist in basinwide maximum for the High group.
- no statistical significance testing was conducted; the focus is on estimation rather than inference. Tables 1 & 2 indicate standard errors (standard deviations of the mean) approximately equal to 0.007 ppm for High group and 0.004 ppm for All Days. With this info, it’s possible to draw confidence intervals around the means; however, one should be warned that testing for significant differences between days would need to take into account the correlation between days rather than assuming independence.

IV. Conclusions

- the weekend effect is not “exacerbated” or “intensified” under ozone-conducive conditions in the SoCAB.
- the weekend pattern for basinwide daily 1-hour maximum concentrations is similar for days which are highly or lowly ozone-conducive.

V. Tables and Figures

- Table 1 lists the mean residual concentrations and their standard deviations for each of the 4 categories in the pre-CBG period: High, Low, Medium and All Days. Table 2 lists similar information for the post-CBG period.
- Figure 1 is a scatterplot of the basinwide daily maximum 1-hour ozone concentration in the pre-CBG period, with the “smoothed” line superimposed. Figure 2 displays similar information for the post-CBG period.
- Figure 3 displays the means from Table 1 in graphical form. Figure 4 displays those from Table 2.

Table 1. Mean residual ozone concentrations, 1992-1994.

1992-94 Group	Day of Week	No. of Observations	Mean Residual Concentration	Standard Deviation of Mean
High	Sunday	24	0.0292	0.0069
High	Monday	21	0.0223	0.0071
High	Tuesday	22	0.0084	0.0068
High	Weds.	24	0.0194	0.0071
High	Thursday	23	0.0289	0.0077
High	Friday	27	0.0175	0.0090
High	Saturday	24	0.0265	0.0095
Low	Sunday	28	-0.0113	0.0087
Low	Monday	28	-0.0275	0.0067
Low	Tuesday	26	-0.0266	0.0052
Low	Weds.	27	-0.0246	0.0062
Low	Thursday	28	-0.0215	0.0053
Low	Friday	21	-0.0270	0.0058
Low	Saturday	24	-0.0160	0.0071
Medium	Sunday	22	0.0054	0.0085
Medium	Monday	25	-0.0111	0.0082
Medium	Tuesday	26	-0.0104	0.0060
Medium	Weds.	23	-0.0029	0.0062
Medium	Thursday	23	-0.0065	0.0057
Medium	Friday	26	-0.0027	0.0052
Medium	Saturday	26	0.0267	0.0078
All Days	Sunday	74	0.0068	0.0051
All Days	Monday	74	-0.0078	0.0048
All Days	Tuesday	74	-0.0105	0.0038
All Days	Weds.	74	-0.0036	0.0043
All Days	Thursday	74	-0.0012	0.0043
All Days	Friday	74	-0.0022	0.0046
All Days	Saturday	74	0.0128	0.0052

Table 2. Mean residual ozone concentrations, 1996-1998.

1996-98 Group	Day of Week	No. of Observations	Mean Residual Concentration	Standard Deviation of Mean
High	Sunday	25	0.0246	0.0070
High	Monday	22	0.0027	0.0055
High	Tuesday	25	0.0121	0.0056
High	Weds.	24	0.0200	0.0063
High	Thursday	22	0.0244	0.0077
High	Friday	23	0.0112	0.0056
High	Saturday	22	0.0275	0.0054
Low	Sunday	27	-0.0036	0.0041
Low	Monday	31	-0.0154	0.0037
Low	Tuesday	27	-0.0164	0.0036
Low	Weds.	27	-0.0139	0.0044
Low	Thursday	31	-0.0167	0.0047
Low	Friday	29	-0.0137	0.0045
Low	Saturday	26	-0.0119	0.0045
Medium	Sunday	22	0.0079	0.0062
Medium	Monday	21	-0.0047	0.0044
Medium	Tuesday	22	-0.0119	0.0056
Medium	Weds.	23	-0.0103	0.0055
Medium	Thursday	21	-0.0035	0.0049
Medium	Friday	22	-0.0076	0.0049
Medium	Saturday	26	0.0134	0.0052
All Days	Sunday	74	0.0094	0.0036
All Days	Monday	74	-0.0070	0.0027
All Days	Tuesday	74	-0.0055	0.0032
All Days	Weds.	74	-0.0018	0.0035
All Days	Thursday	74	-0.0007	0.0038
All Days	Friday	74	-0.0041	0.0031
All Days	Saturday	74	0.0087	0.0034

Figure 1. Basinwide daily maximum 1-hour ozone (in ppm), 1992-94, with smoothed line superimposed.

South Coast Basinwide Daily Max 1 Hour Ozone Conc, 1992-94

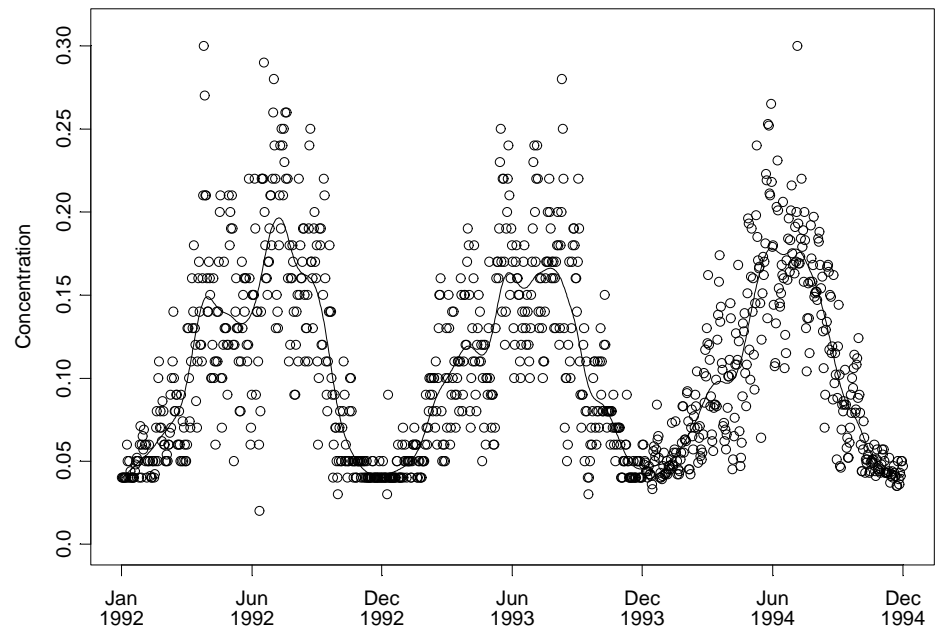


Figure 2. Basinwide daily maximum 1-hour ozone (in ppm), 1996-98, with smoothed line superimposed.

South Coast Basinwide Daily Max 1 Hour Ozone Conc, 1996-98

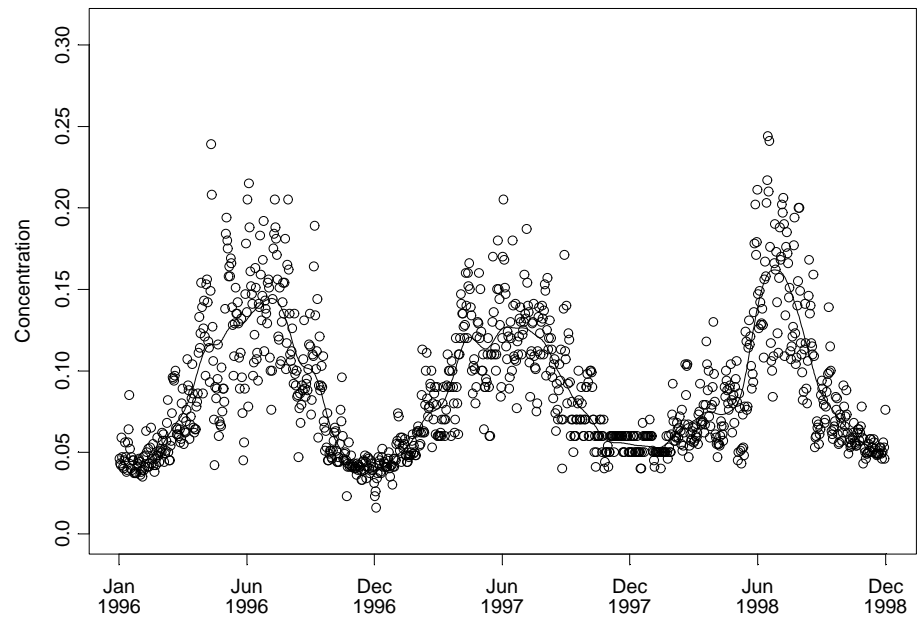


Figure 3. Mean residual ozone concentrations by day of week, 1992-1994.

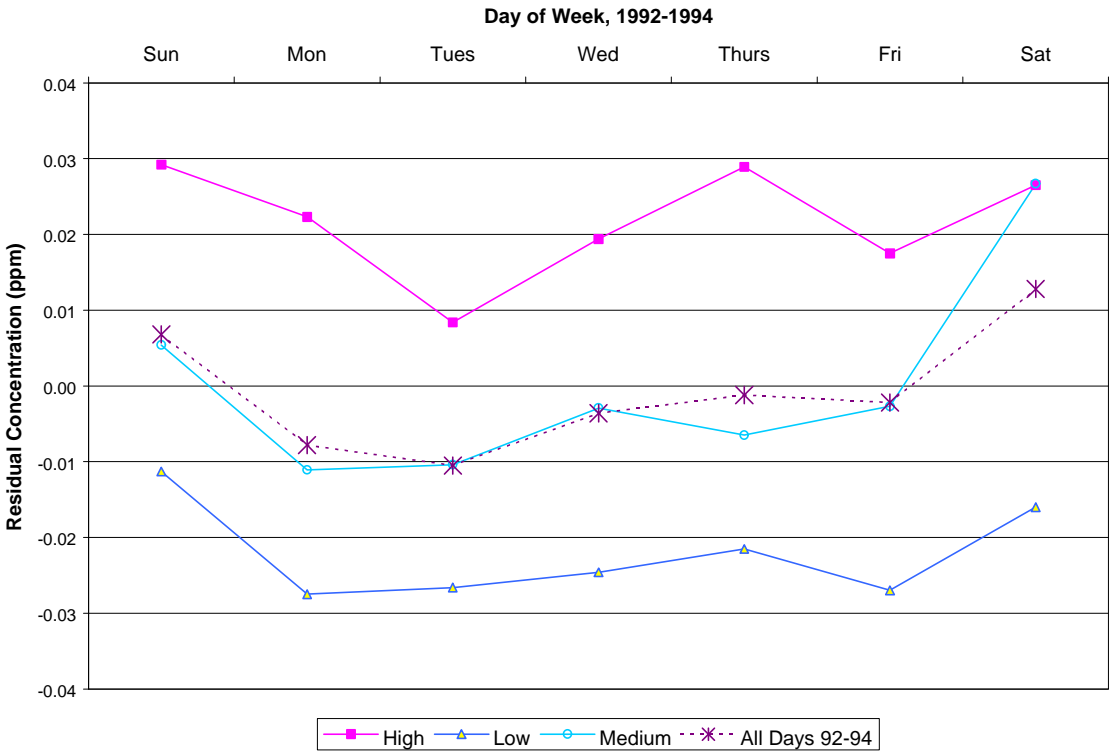


Figure 4. Mean residual ozone concentrations by day of week, 1996-1998.

